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. Seminars

## 2016 NCTS Workshop on Dynamical Systems

August 15 - 18, 2016

Room 202, Astronomy-Mathematics Building, NTU

**Invited Speakers:**

Yongluo Cao ( Suzhou University )  
Ercai Chen ( Nanjing Normal University )  
Shilei Fan ( Central China Normal University )  
Wen-Guei Hu ( Sichuan University )  
Wen Huang ( Sichuan University )  
Derong Kong ( Yangzhou University )  
Wen-Xin Qin ( Suzhou University )  
Hui Rao ( Central China Normal University )  
Yaokun Wu ( Shanghai Jiao Tong University )  
Shi-Liang Wu ( Xidian University )  
Yun Zhao ( Suzhou University )  
Dejun Feng ( The Chinese University of Hong Kong )  
Kasing Lau ( The Chinese University of Hong Kong )  
Yang Wang ( The Hong Kong University of Science and Technology )  
Tomoki Kawahira ( Tokyo Institute of Technology )  
**Mansoor Saburov ( International Islamic University Malaysia )**  
William C. Abram ( Hillsdale College )  
Ai-Hua Fan ( Université de Picardie )  
Yunping Jiang ( The City University of New York )  
Jeffrey C. Lagarias ( University of Michigan )  
Lingmin Liao ( Université Paris-Est Créteil )  
Tao Luo ( City University of Hong Kong )  
Blake Temple ( University of California, Davis )

**Organizers:**

**Jung-Chao Ban ( National Dong Hwa University )**  
Kuo-Chang Chen ( National Tsing Hua University )  
Cheng-Hsiung Hsu ( National Central University )  
Ai-Hua Fan ( Université de Picardie )  
Yunping Jiang ( The City University of New York )



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10617 No.1, Sec. 4, Road Roosevelt, Taipei City, Taiwan

Assist Prof Dr Mansoor Saburov  
Department of Computational & Theoretical Science  
Kulliyah of Science  
International Islamic University Malaysia

March 15, 2016

Dear Professor Saburov,

On behalf of Mathematics Division, National Center for Theoretical Sciences (NCTS) and the organizing committee, I am pleased to invite you to visit our center for the period of August 14 -19, 2016 and to give **an invited talk** at 2016 NCTS Workshop on Dynamical Systems August 15 -18, 2016. For this trip NCTS will support you an honorarium to cover your local expenses.

If you have any further question, please do not hesitate to contact us. For more information about NCTS, please see the web page <http://www.ncts.ntu.edu.tw/>.

We look forward to seeing you.

Sincerely Yours,  
Jungkai A. Chen

A blue ink handwritten signature, appearing to be 'JK Chen', is written over a blue ink stamp.

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# 2016 NCTS Workshop on Dynamical Systems & 2016 China、 Hong Kong、 Taiwan joint conference on dynamical systems

## Conference Schedule

### Monday, 15 August 2016

9:30	Registration and opening
	Chair : Song-Sun Lin, National Chiao Tung University, Taiwan
10:10-11:00	Kasing Lau, The Chinese University of Hong Kong, HK Title :
	Chair : Kuo-Chang Chen, National Tsing Hua University, Taiwan
11:10-12:00	Dejun Feng, The Chinese University of Hong Kong, HK Title :
	Lunch
	Chair : Hui Rao, Central China Normal University, China
13:30-14:20	Wen-Xin Qin, Suzhou University, China Title :
	Tea Break
	Chair : Chih-Hung Chang, National University of Kaohsiung, Taiwan
14:40-15:30	Derong Kong, Yangzhou University, China Title :
	Chair : Shilei Fan, Central China Normal University, China
15:40-16:30	Lingmin Liao, Université Paris-Est Créteil Val de Marne, France Title :
	Chair : Lingmin Liao, Université Paris-Est Créteil Val de Marne, France
16:40-17:30	Mansoor Saburov, Kulliyah of Science International Islamic University Malaysia, Malaysia Title :
18:00	Banquet

### Tuesday, 16 August 2016

	Chair : Jung-Chao Ban, National Dong Hwa University, Taiwan
10:10-11:00	Yang Wang, The Hong Kong University of Science and Technology, HK Title :
	Chair : Cheng-Hsiung Hsu, National Central University, Taiwan
11:10-12:00	John M. Hong, National Central University, Taiwan Title :
	Lunch

# Ergodic Theory of Nonlinear Markov Operators with Applications in Nonlinear Consensus Problems

MANSOOR SABUROV

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A consensus problem of multi-agent systems has been considered a dual problem to Markov chains. Historically, an idea of reaching consensus through linear repeated averaging was introduced by DeGroot (see [1]) for a structured *time-invariant* and synchronous environment. Since that time, the consensus which is the most ubiquitous phenomenon of multi-agent systems becomes popular in various scientific communities, such as biology, physics, control engineering and social science. In [2], Chatterjee and Seneta considered a generalization of DeGroot's model for the structured *time-varying* synchronous environment. Based on the ergodic theory of non-homogeneous Markov chains, the theory of linear consensus problems for structured *time-varying* environment was established very well [2].

In this plenary talk, we shall present the ergodic theory of nonlinear Markov chains which enables to study the nonlinear consensus problems for the structured *time-invariant* as well as *time-varying* synchronous environment. This theory was developed in the series of papers [3, 4, 5, 6]. This work was supported by Ministry of Higher Education (MOHE) grant FRGS14-141-0382.

## References

- [1] M.H. DeGroot, *Reaching a consensus*, J Amer Stat Assoc. **69** (1974) 118–121.
- [2] S. Chatterjee and E. Seneta, *Towards consensus: some convergence theorems on repeated averaging*, J Appl. Prob. **14** (1977) 89–97.
- [3] M. Saburov, *Ergodicity of nonlinear Markov operators on the finite dimensional space*, Nonlinear Analysis: Theo. Method. & Appl. **143** (2016), 105–119.
- [4] M. Saburov and Kh. Saburov, *Mathematical models of nonlinear uniform consensus*, ScienceAsia **40**(4) (2014) 306–312 .
- [5] M. Saburov and Kh. Saburov, *Reaching a nonlinear consensus: Polynomial stochastic operators*, Inter. J. of Cont. Auto. Sys. **12**(6) (2014) 1276–1282.
- [6] M. Saburov and Kh. Saburov, *Reaching a consensus: a discrete nonlinear time-varying case*, Inter. J. Sys. Sci. **47**(10) (2016) 2449–2457.